PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Improvements in Electric Circuit Breakers

We, GENERAL ELECTRIC COMPANY, a corporation organized and existing under the laws of the State of New York, United States of America, residing at 1 River Road, Schenectady 5, New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to electric circuit breakers, and more particularly to circuit breakers of the type incorporating thermal current responsive means to cause tripping upon the occurrence of predetermined abnormal current conditions therethrough.

Thermal current responsive means have been used for many years in electric circuit breakers to detect abnormal current conditions to cause actuation of the circuit breaker to interrupt the circuit. Such thermal current responsive means have two major advantages over other types of current responsive means such, for example, as magnetic current responsive means. These advantages are: 1) thermal current responsive means have an inherent heat storage characteristic which can be made to match quite closely the heat storage characteristics of the circuit conductors which electric circuit breakers are ordinarily utilized to protect. Secondly, thermal current responsive means can be constructed relatively inexpensively, by use of bimetallic current responsive members, such as an elongated strip of bimetallic material.

Thermal current responsive means, however, have a characteristic not shared by magnetic type devices which, although it is a further advantage in some applications, constitutes a disadvantage in certain other applications. This characteristic is the fact that thermal current responsive devices are affected by heat which originates from sources other than the particular heat sources which are primarily intended to affect them. More specifically, such devices are affected by the temperature of the circumambient air (referred to hereinafter for convenience simply as "ambient temperature"). Thus, for example, a circuit breaker including a thermal current responsive means may sometimes trip and disconnect the circuit primarily because the temperature of the surrounding air has increased to a predetermined point, even though the current through the circuit breaker has not reached a level which would ordinarily be dangerous. For this reason, it is customary to advise users of thermal current responsive devices such as circuit breakers, that the device must be "derated" if used at elevated ambient temperatures. In other words, the user is advised for example that a circuit breaker which is rated at 15 amperes will carry 15 amperes indefinitely at an ambient temperature of 25°C. At an ambient temperature of 50°C., however, the same breaker will carry not more than 13.8 amperes without tripping. The breaker must therefore be "derated" to 92% of its nominal value if used in an ambient of 50°C. As previously mentioned, such "ambient sensitivity" is sometimes desirable, for the following reason. The ultimate object of automatic circuit protection is to prevent the conductor which is connected to the protecting device from reaching a temperature which might be dangerous to itself, such as by causing melting, or might be dangerous to adjacent material such as the wire insulation or adjacent building material, so as to possibly start a fire. It will be apparent that if a large portion of the temperature of the conductor is caused by means such as by a high ambient temperature, then the conductor should not be permitted to carry as much current as it otherwise could.

[*Price 4s. 6d.*]

Nevertheless, *up until a certain danger point is reached,* it is desirable to prevent ambient temperature from unduly restricting the ability of a circuit protective device to remain in the closed condition. For this reason, a variety of schemes have been devised over the years for "compensating" or correcting thermal current responsive devices for ambient temperatures. Such "ambient compensation" means have commonly included the use of supplementary bimetallic strip means which is exposed to the ambient temperature in the same way that the current responsive bimetallic member is, but which is not exposed to heat caused by electrical current carried by the circuit, or at least not to the same degree as the main current responsive thermal element.

All of such prior art ambient compensating or correcting means for thermal current responsive devices have shared a major disadvantage in common. This disadvantage is that they have added significantly to the cost of such devices. In addition, since they have commonly added more parts and complicated the structure involved, their use increases the likelihood of some difficulty being encountered in the use of the device.

A further disadvantage of such prior art structures is that since they have ordinarily involved the use of a supplementary bimetallic member which acts contrary to the action of the main current responsive bimetal, the compensating action becomes greater with greater ambient temperatures, without practical limit. The use of such "ambient compensating" structures over a period of years has made it evident that some means should be used to limit the compensating action. Thus, for example, if the ambient temperature surrounding a circuit protective device increases to extremely high values, such, for example, as because of a fire nearby, it would be desirable for the protective device to operate to a tripped condition for general safety purposes. This would not be possible with prior art "ambient compensating" schemes. For such reasons, it has been found necessary to include in devices of this type some means for "limiting" the compensating action provided, so that the compensating means operates over a certain range of ambient temperature, but after a certain predetermined ambient temperature is reached, the compensating means no longer functions.

In accordance with the present invention, a thermal current responsive device is provided which does not include a separate "ambient compensating" element, but which exhibits an ambient correcting or compensating action which is virtually indistinguishable from the action of prior art thermal current responsive devices including separate ambient compensating means. This is achieved, moreover, in preferred embodiments, without the use of any more parts than utilized in prior art uncompensated thermal current responsive devices.

Accordingly, it is an object of this invention to provide a thermal current responsive device which is not adversely affected by elevated ambient temperatures, and which does not require the use of a separate ambient compensating means.

According to this invention there is provided an electric circuit breaker comprising a tripping mechanism arranged for actuation in response to a predetermined degree of bending of a bimetallic strip having one end fixed and the other end free, and including an elongated member having one end arranged for movement with the free end of the strip and having its other end arranged to permit actuation of the tripping mechanism upon occurrence of a predetermined movement of said other end, wherein the elongated member extends substantially from the free end of the strip in a general direction having a positive component parallel to the general direction from the free to the fixed end of the strip, the arrangement being such that bending of the strip due to a unit change in the heating effect caused by ambient temperature variation causes movement of said other end of said elongated member to a relatively small extent and bending of the strip due to a unit change in the heating effect caused by variation of the current in the circuit breaker causes movement of said other end to a relatively large extent.

The invention will be more fully understood from the following detailed description of various embodiments thereof, presented by way of example only and with reference to the accompanying drawings, in which:—

FIGURE 1 is a side elevation view of an electric circuit breaker constructed in accordance with the invention, a part of the insulating casing closest to the observer being omitted to show the internal parts;

FIGURE 2 is a perspective view of the current responsive means of the circuit breaker of FIGURE 1;

FIGURE 3 is a side elevation view of a portion of the circuit breaker of FIGURE 1, the parts being shown in a condition which they assume when the assembly is heated substantially entirely by elevated ambient temperature;

FIGURE 4 is a view similar to FIGURE 3, but showing the parts in a thermally tripped condition;

FIGURE 5 is a fragmentary perspective view of a portion of thermal current responsive means of another embodiment of the invention;

FIGURE 6 is a side elevation view of the thermal current responsive means of a third embodiment of the invention;

FIGURE 7 is a side elevation view of a thermal current responsive means of a fourth embodiment of the invention;

FIGURE 8 is an exploded perspective view of the thermal current responsive means of FIGURE 7;

FIGURE 9 is a view similar to FIGURE 7 but showing the parts in a position which they occupy upon tripping magnetically.

FIGURE 10 is a view similar to FIGURE 9 but showing the parts in the position which they occupied when heated primarily by ambient temperature;

FIGURE 11 is a graphical representation showing various characteristics of the invention.

Referring first to FIGURE 1, the invention is shown as incorporated in an electric circuit breaker comprising a generally rectangular insulating casing, including a generally tray-shaped body portion 10 and a generally planar cover, not shown, fitting on the body 10 and closing the side exposed to the observer in FIGURE 1.

A stationary line terminal member 11 is mounted in a conforming recess in the casing 10. The line terminal 11 is generally U-shaped and is adapted to receive a blade-type stationary terminal, not shown. The terminal 11 includes an integral lug portion 11A carrying a stationary contact 11B thereon. A movable contact 12 is fixedly carried by a contact arm 13. The contact arm 13 is pivotally mounted at a pivot point 13A on an insulating handle 14, which in turn is pivotally supported in the casing 10 on an integral pivotal support or hub 15. A generally U-shaped releasable support 16 is also pivotally supported in the casing body 10 on a pivot pin 17, and a tension-type operating spring 18 is interconnected between the contact arm 13 and an anchor point 19 on the handle 14. Rotation of the handle 14 about its pivotal support 15 in the casing moves the pivotal support point 13A of the contact arm 13 back and forth across the line of action of the tension spring 18 and moves the contact arm 13 between open and closed circuit positions with respect to the stationary contact 11B with a snap-action.

The end 16A of the releasable support 16 remote from its pivotal supporting pin 17 is releasably latched in the position shown in FIGURE 1 by current-responsive means to be described.

When the contact arm 13 is in closed-circuit position and the support member 16 is released from the current-responsive means, the tension spring 18 acts on it to cause rotation in clockwise direction as viewed in FIGURE 1. Clockwise rotation of the support member 16 moves the anchor point 19 of the spring 18 across the pivot point 13A of the contact arm 13, thereby reversing the bias of the spring 18 on the contact arm 13 and moving the contact arm to automatically-opened or "tripped" position.

Following tripping action, the parts may be returned to the "off" position as indicated in FIGURE 1 by rotating the handle 14 clockwise about its pivotal support 15 back to its FIGURE 1 position. This causes the projection 14A of the handle 14 to engage a pin 20 carried by the releasable support member 16, and to rotate the support member 16 counterclockwise about its pivotal support 17 to relatched position as shown in FIGURE 1.

It should be understood that the particular operating mechanism utilized may be of any suitable type including a member which is moved to cause automatic opening, and that the particular mechanism illustrated herein is chosen merely as an example. The construction and operation of the mechanism illustrated is more specifically described in our co-pending patent application No. 44183/65 (Serial No. 1088698).

Current Responsive Means

For the purpose of normally restraining the releasable support member 16 and for releasing it upon the occurrence of predetermined conditions in accordance with the invention, current responsive means is provided which will now be described. The current responsive means includes a combined armature-latch member of sheet metallic material 22, which is pivotally supported at 23 in the insulating casing, and is biased for clockwise rotation about its pivotal support by a compression spring 24. The armature-latch member 22 includes a widened portion 25 to enhance its operation as a magnetic armature, in a manner to be described, and an integral bent-over latch projection 26.

An elongated bimetallic strip 28 is also included which is rigidly attached by suitable means, such as by welding, to an end portion 29A of a terminal strap member 29. The terminal strap member 29 is fixedly attached to the insulating body 10 at an intermediate point by suitable means such as by a screw 30, and includes at its outer end a wire-connecting screw 31.

For the purpose of adjustably positioning the bimetallic strip 28, a calibrating screw 32 is provided which is threadedly engaged in a nut 33 trapped in a conforming recess in the body 10. The inner end of the screw 32 bears on the end 29A of the strap 29, and adjustment of the screw 32 causes more or less bending of the strap 29 intermediate the end 29A and the screw 30, thereby changing the angle of the bimetallic strip 28 in the casing 10.

The bimetallic strip 28 also carries a generally U-shaped magnetic field piece 34 attached thereto by suitable means such as by welding.

The bimetallic strip 28 is connected to the

armature-latch member 22 by means of an angularly-extending connecting piece 35. The movable end of the bimetallic strip 28 is electrically connected to the movable contact member 13 by means of a flexible conductor 36. The current path through the circuit breaker therefore is from the line terminal 11 to the stationary contact 11B, to the movable contact 12, to the flexible conductor 36, to the movable end of the bimetallic strip 28, to the terminal strap 29, to the load terminal 31. The current responsive means operates to cause release or tripping of the circuit breaker in either one of two ways, depending upon the magnitude of the excess current, that is, either magnetically or thermally. Magnetic tripping takes place upon the occurrence of extremely high overload currents, such as those of short-circuit value. The magnetic field piece 34 is energized and attracts the armature portion 25 of the armature-latch member 22, and withdraws the latch projection 26 from the portion 16A of the member 16 against the bias of the spring 24, thereby causing tripping. In accordance with the embodiment of the invention shown in FIGURE 5, the sensitivity of the magnetic field piece 34 may be greatly increased by the provision of additional turns such as 34A which are between the bimetallic strip 28 and the flexible conductor 36. The addition of the extra coils 34A is made possible by making the magnetic field piece 34 substantially wider than the bimetallic strip 28.

Thermal tripping takes place upon the occurence of electrical currents which are above the normal or rated value of the circuit breaker and below the excessively high or short-circuit values which cause magnetic tripping. Such intermediate overload currents cause warping of the bimetallic strip 28 so as to move the lower end thereof to the right as viewed in FIGURE 1, thereby acting through the means of the connecting means 35, on the armature-latch member 22 to move it to the right to cause tripping.

In accordance with the invention, the thermal tripping means comprising the bimetallic strip 28, the latch 22, and the connecting means 35, is constructed in such a manner that elevated ambient temperatures do not have the adverse effect upon the thermal tripping characteristics which they do in comparable prior art thermal current responsive devices. Because of the construction provided by the present invention, the thermal tripping means responds with a greater latch-moving action to heating due to electric current than to heating due to elevated ambient temperatures. It is possible, in accordance with the invention to construct a thermal current responsive device which is entirely unaffected by elevated ambient temperatures. In the preferred form, however, the current-responsive means of the invention is slightly sensitive to heating due to ambient temperature action. This is for purposes of safety, since it is desired to allow the circuit breaker to trip if the bimetallic strip is heated due solely to ambient temperature of a sufficiently high degree.

In accordance with the invention, the connecting member 35 which connects the movable end of the bimetallic strip 28 to the latch member 22 extends a substantial distance back toward the fixedly mounted end of the bimetallic strip 28, and the end 35A engages the latch member 22 at a point spaced a substantial distance from this movable end.

In accordance with a particular embodiment of the invention, it has been found that an adequate ambient correcting or compensating action is obtained which meets all requirements of such devices, with a construction as follows: circuit breaker rating 15 amperes; bimetallic strip total length 1.750 inches; length of connecting member .750 inches; original distance of end 35A from the nearest point of the bimetallic strip .187 inches. The significant characteristics of this embodiment are shown in the graph entitled "Derating Curve" of Figure 11. This graph indicates the percentage of "derating" which is necessary for various ambient temperatures. The line "A" represents the curve of a prior art breaker of this corresponding type without ambient compensating action. Line "B" represents the corresponding curve of the above-mentioned embodiment of the present invention.

As indicated in the graph of FIGURE 11, the prior art circuit breaker is capable of carrying 122% of its normal rated current at an ambient temperature of 25°C. When the ambient temperature is increased to 50°C, however, this same circuit breaker will carry only 93% of its rated current without tripping. The circuit breaker constructed in accordance with the present invention, however, carries 113% of its rated current at 25°C, and at 50°C carries 107% of its rated current. In other words, the current-carrying capacity of the circuit breaker incorporating the present invention is much less affected by ambient temperature than the illustrated prior art circuit breaker.

It is not certain that the theory of operation of applicant's invention is completely understood. This is because its operation involves the inter-action of many factors such as: rate of heat generation by electric current in the various conducting parts; rate of heat exchange of both generated heat and heat from the circumambient air, by conduction, radiation and absorption; friction forces; and deflection versus loading characteristics of the bimetallic member, all of which act over a period of time during which all or most of these factors are acting dynamically. It is applicant's hypothesis, however, that the in-

vention operates in accordance with the following principles.

It is believed that the basic principle on which applicants invention operates is that there is a difference in the deflecting action of a bimetallic strip of the type illustrated when it is heated by ambient temperature as compared to its deflection when it is heated by the passage of electric current therethrough. Specifically, when the bimetallic strip is heated by ambient temperature, it is heated uniformly throughout, and all adjacent parts and parts in contact with it are also heated at substantially precisely the same rate. Thus, all points of the bimetallic strip 28, as well as the magnetic field piece 34, the terminal strap 29, and the flexible conductor 36 all have substantially the same temperature at all times. Accordingly, if the ambient temperature is increased, the temperature of all these parts increases uniformly therewith. When the bimetallic strip is heated by such ambient temperatures therefore, it deflects equally throughout its length and assumes a condition closely approximating a segment of a circle, the radius of the circle decreasing as the ambient temperature is increased.

When the bimetallic strip 28 is heated by the passage of current therethrough, however, it is not heated uniformly throughout its length even though the current passes through the entire strip. This is because the heat generating, heat storage, and heat radiating characteristics of the various components involved are different. Specifically, it is believed that when bimetallic strip 28 is heated by current passing therethrough, it deflects more sharply adjacent its fixedly supported end than it does adjacent its movable end. This is believed to be due to several factors such as the fact that the conductor 29 is ordinarily selected to act partly as a heater, whereas the flexible conductor 36 is not. In addition, the magnetic field piece 34 acts as a "heat sink" and also as a heat radiator.

The net result, therefore, is believed to be such that on current-generated thermal tripping, most of the deflection which operates to move the end 35A occurs in the upper portion of the bimetallic strip 28. Since heating occurs primarily by current, the lower part of the bimetallic strip does not deflect as much as the upper portion, and the net result of the components of movement on the member 35 is such as to move the portion 35A to the right to cause tripping.

When deflection occurs primarily because of elevation of ambient temperature, however, the lower portion of the bimetallic strip 28 deflects equally with the upper portion, and the movable end 28A of the bimetallic strip 21 not only moves to the right as viewed, but also changes its angle substantially as it does so. This change of angle tends to tilt the connecting member 35 counterclockwise with respect to its original position, thereby moving the end 35A to the left as viewed. This tilting action tends to offset or counteract the movement of the piece to the right as viewed, and provides a "compensating" action.

In the embodiment of the invention shown in FIGURE 6, there is illustrated an expedient whereby the compensating action of the assembly can be further increased by passing current only through the major upper portion of the bimetallic strip 128. The operation of this form of the invention is substantially the same as that described in connection with FIGURES 1 through 5. The form shown in FIGURES 1 through 5, is preferred for use in applications of relatively low rated breakers, such for example as 15—20 amperes, and the form shown in FIGURE 6 is preferred for use in higher rated breakers such for example as 30—50 amperes.

In FIGURES 7—10, there is shown another embodiment of the invention. In accordance with this embodiment, a bimetallic strip 228 has a magnetic field-piece 234 rigidly attached thereto at the point 234A by suitable means such as by welding. The member 234 has an opening or window 234B through which a portion of the bimetallic strip 228 extends, so that a portion of the bimetallic strip 228 lies in the same plane as a portion of the member 234.

An armature piece 235 is hingedly supported on the lower end of the magnetic field-piece 234 and includes a projecting lug 235A which engages a bent-out tab or lug 222A of the latch member 222. A coil 240 is wound about the field piece 234, also encircling the portion of the bimetallic strip 228 that passes therethrough. One end 240A of the coil 240 is rigidly connected to the bimetallic strip, by suitable means such as by welding, adjacent the fixedly mounted end of the field-piece 234. The other end 240B of the coil 240 is connected to the flexible conductor 236. The lower end of the bimetallic strip 228 therefore is not in the electrical circuit, which passes from the flexible conductor 236 through the coil 240 to the bimetallic strip 228, and out the terminal strap 229.

The thermal-deflecting and ambient-correcting action of this form of the invention is generally similar to that of FIGURE 6. It will be noted in this connection that the spacing of the lug 235A from the main body of the bimetallic strip, which controls the amount of latch engagement, is controlled by an extension 235B which engages the lowest extreme end 228A of the bimetallic strip 228. Deflection of the lower end of the bimetallic strip 228, occurs primarily due to ambient-temperature changes, and this permits the lug 235A to move away from the body of the bimetallic strip, in a correcting direction. Thermal tripping occurs by deflection of the

upper portion of the bimetallic strip 228, which moves the lower assembly to the right as viewed substantially as a unit, to cause tripping movement of the latch 222.

In the form of the invention shown in FIGURE 7—10, the piece 235 serves also as a magnetic armature, which is attracted to the piece 234 upon the occurence of sufficient current through the coil 240. The portion 234A of the member 234 acts as a magnetic pole piece to attract the armature, as shown in FIGURE 9.

WHAT WE CLAIM IS:—

1. An electric circuit breaker comprising a tripping mechanism arranged for actuation in response to a predetermined degree of bending of a bimetallic strip having one end fixed and the other end free, and including an elongated member having one end arranged for movement with the free end of the strip and having its other end arranged to permit actuation of the tripping mechanism upon occurrence of a predetermined movement of said other end, wherein the elongated member extends substantially from the free end of the strip in a general direction having a positive component parallel to the general direction from the free to the fixed end of the strip, the arrangement being such that bending of the strip due to a unit change in the heating effect caused by ambient temperature variation causes movement of said other end of said elongated member to a relatively small extent and bending of the strip due to a unit change in the heating effect caused by variation of the current in the circuit breaker causes movement of said other end to a relatively large extent.

2. A circuit breaker as claimed in claim 1 wherein the arrangement is such that bending of the strip due solely to the increase in the heating effect caused by an increase of the ambient temperature causes sufficient movement of said other end of said elongated member to permit actuation of said tripping mechanism when said ambient temperature rises above a predetermined value.

3. A circuit breaker as claimed in claim 1 or claim 2 wherein said one end of the elongated member is secured to the free end of the bimetallic strip.

4. A circuit breaker as claimed in claim 1 or claim 2 wherein the elongated member is trapped between the bimetallic strip and the tripping mechanism by means of projections carried by the strip and the tripping mechanism.

5. A circuit breaker as claimed in any one of the preceding claims including a magnetic field piece fixedly attached to said bimetallic strip intermediate the ends of the strip, and a movable armature arranged to permit actuation of the tripping mechanism upon movement of the armature, whereby current passing through said bimetallic strip energises said field piece to attract the armature towards the field piece.

6. A circuit breaker as claimed in claim 5 wherein said field piece is generally U-shaped having a bight portion substantially wider than said bimetallic strip, and a coil carried by said bight portion, said coil having one end electrically connected to said bimetallic strip and the other end electrically connected to one of the terminals of the circuit breaker, whereby current passing through said bimetallic strip and said coil causes attraction of the armature towards the field piece.

7. A circuit breaker as claimed in claim 6 wherein said one end of the coil is connected to the bimetallic strip at a point adjacent the point of attachment of said field piece to the strip, whereby the portion of the strip between the point of connection of the coil and the free end of the strip is not in electrical circuit with the terminals of the circuit breaker.

8. A circuit breaker as claimed in any one of the preceding claims wherein said elongated member extends adjacent the high expansion side of said strip, whereby bending of said strip due to an increase in its temperature causes the elongated member to move in a direction away from the high expansion side.

9. An electric circuit breaker substantially as described with reference to Figures 1 to 4 or Figure 5 or Figure 6 or Figures 7 to 10 of the accompanying drawings.

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upper portion of the bimetallic strip 228, which moves the lower assembly to the right as viewed substantially as a unit, to cause tripping movement of the latch 222.

In the form of the invention shown in FIGURE 7—10, the piece 235 serves also as a magnetic armature, which is attracted to the piece 234 upon the occurence of sufficient current through the coil 240. The portion 234A of the member 234 acts as a magnetic pole piece to attract the armature, as shown in FIGURE 9.

WHAT WE CLAIM IS:—

1. An electric circuit breaker comprising a tripping mechanism arranged for actuation in response to a predetermined degree of bending of a bimetallic strip having one end fixed and the other end free, and including an elongated member having one end arranged for movement with the free end of the strip and having its other end arranged to permit actuation of the tripping mechanism upon occurrence of a predetermined movement of said other end, wherein the elongated member extends substantially from the free end of the strip in a general direction having a positive component parallel to the general direction from the free to the fixed end of the strip, the arrangement being such that bending of the strip due to a unit change in the heating effect caused by ambient temperature variation causes movement of said other end of said elongated member to a relatively small extent and bending of the strip due to a unit change in the heating effect caused by variation of the current in the circuit breaker causes movement of said other end to a relatively large extent.

2. A circuit breaker as claimed in claim 1 wherein the arrangement is such that bending of the strip due solely to the increase in the heating effect caused by an increase of the ambient temperature causes sufficient movement of said other end of said elongated member to permit actuation of said tripping mechanism when said ambient temperature rises above a predetermined value.

3. A circuit breaker as claimed in claim 1 or claim 2 wherein said one end of the elongated member is secured to the free end of the bimetallic strip.

4. A circuit breaker as claimed in claim 1 or claim 2 wherein the elongated member is trapped between the bimetallic strip and the tripping mechanism by means of projections carried by the strip and the tripping mechanism.

5. A circuit breaker as claimed in any one of the preceding claims including a magnetic field piece fixedly attached to said bimetallic strip intermediate the ends of the strip, and a movable armature arranged to permit actuation of the tripping mechanism upon movement of the armature, whereby current passing through said bimetallic strip energises said field piece to attract the armature towards the field piece.

6. A circuit breaker as claimed in claim 5 wherein said field piece is generally U-shaped having a bight portion substantially wider than said bimetallic strip, and a coil carried by said bight portion, said coil having one end electrically connected to said bimetallic strip and the other end electrically connected to one of the terminals of the circuit breaker, whereby current passing through said bimetallic strip and said coil causes attraction of the armature towards the field piece.

7. A circuit breaker as claimed in claim 6 wherein said one end of the coil is connected to the bimetallic strip at a point adjacent the point of attachment of said field piece to the strip, whereby the portion of the strip between the point of connection of the coil and the free end of the strip is not in electrical circuit with the terminals of the circuit breaker.

8. A circuit breaker as claimed in any one of the preceding claims wherein said elongated member extends adjacent the high expansion side of said strip, whereby bending of said strip due to an increase in its temperature causes the elongated member to move in a direction away from the high expansion side.

9. An electric circuit breaker substantially as described with reference to Figures 1 to 4 or Figure 5 or Figure 6 or Figures 7 to 10 of the accompanying drawings.

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